Remarks

Claims 1-61 are pending in the present application. Reexamination and reconsideration are requested in light of the accompanying amendment and remarks.

Under the heading "Claims Analysis," the examiner has identified the statutory class as an apparatus for claims 36-61. As discussed in the Amendment of December 13, 2006, Applicants believe the catalyst systems could also be considered compositions.

The rejection of claim 1 under 35 U.S.C. § 112, second paragraph as being indefinite has been overcome. Claim 1 has been amended to recite "a promoter comprising yttrium, alkali metals, or alkaline earth metals, or combinations thereof." Support for this amendment can be found at Paragraphs [0013, and 0032], and claim 1 as filed. This amendment has been made for purposes of clarity and for no other purpose. The amendment does not narrow the claims.

The rejection of claims 1-61 under 35 U.S.C. § 102(b) as being anticipated by, or in the alternative, under 35 U.S.C. § 103(a) as obvious over, Nunan (U.S. Patent No. 6,040,265) is respectfully traversed. Nunan teaches a method of making a promoted support for improved catalysts for conversion of exhaust from internal combustion engines. The support comprises a mixed metal oxide promoter containing at least Ce and Zr substantially uniformly dispersed as homogeneous crystallites of less than about 100 Å on a high surface area refractory oxide support substrate. The method includes dissolving a combination of Ce- and Zr-oxide precursors, and optionally another metal oxide precursor, and a compatible organic depositing agent, slowly heating to transform the depositing agent into a gel-like matrix coating the substrate in which the mixed metal oxide precursor compounds are uniformly distributed and thereafter calcining to burn off the organic matrix and form the appropriate oxide morphology. Abstract.

According to the examiner, "Nunan teaches a method and apparatus for reducing an amount of carbon monoxide in process fuel gas in a water gas shift converter comprising: placing a high activity water gas shift catalyst system into a water gas shift converter (col. 1, lines 43-56 and col. 2, lines 46-52). . . and passing the process fuel gas through the water gas shift converter in effective contact with the high activity water gas shift catalyst system (Ceria based catalyst) and converting a portion of the carbon monoxide in the process fuel gas into carbon dioxide and hydrogen by a water gas shift reaction (col. 1, lines 43-56 and col. 2, lines 46-57)." Contrary to the examiner's statement, Nunan does not teach or suggest use of their

catalyst in a water gas shift converter. Nunan's catalyst is an exhaust gas catalyst for internal combustion engines. See Title; Abstract; col. 1, lines 14-21; col. 2, lines 46-51; col. 4, lines 36-38; col. 7, lines 21-25; col. 9, lines 25-27; col. 9, line 56 to col. 10, line 6; col. 25, lines 3-22; col. 26, lines 20-55; col. 28, lines 35-45; col. 29, lines 10-18; col. 32, lines 38-53; and claims 1-2. Figs. 1-2, and 16-25 show hydrocarbon conversion as a function of the air to fuel (A/F) ratio.

Nunan teaches three way catalysts (TWC) for vehicle exhaust conversion. There are three reactions involved, including: 1) reducing nitrogen oxides to nitrogen and oxygen, $2NO_x \rightarrow xO_2 + N_2$; 2) oxidation of carbon monoxide to carbon dioxide : $2CO + O_2 \rightarrow 2CO_2$; and 3) oxidation of unburned carcinogenic hydrocarbons (HC) to carbon dioxide and water: $2C_xH_y + (2x+y/2)O_2 \rightarrow 2xCO_2 + yH_2O$. See col. 14, lines 27-39; col. 21, lines 17-60, and Tables 3-5, 7-8. These reactions are simultaneous when the A/F ratio is properly adjusted in order to have the proper amount of hydrocarbons to be converted on account of the NO_x which is being reduced.

These reactions are different from the water gas shift reaction, in which the inlet is carbon monoxide and water. The water gas shift reaction involves conversion of carbon monoxide and water to carbon dioxide and water: $CO + H_2O \rightarrow CO_2 + H_2$. Paragraph [0007]. Thus, Nunan's patent, which involves different reactions taking place with different inlet gases and producing different outlet gases, does not teach or suggest using its motor vehicle exhaust conversion catalyst for water gas shift reactions.

The examiner's first citation, col. 1, lines 43-56, does not indicate that Nunan's catalyst could be used in a water gas shift converter. This section primarily discusses prior art motor vehicle exhaust conversion catalysts. In addition, it simply states that it has been suggested that cerium might promote the water gas shift reaction.

> *Motor vehicle exhaust conversion catalysts* are normally operated under conditions which inherently swing between oxidizing and reducing as an oxygen sensor and its control system keep the air/fuel ratio within the desired operating A/F window around the stoichiometric value. Ceria is a well-known component of *such exhaust conversion catalysts*. It is often referred to as an "oxygen storage" agent because it is considered to have the ability to give up oxygen when the catalyst is exposed to reducing conditions and to re-oxidize when exposed to oxidizing conditions. It has also been suggested that ceria may stabilize the support structure, promote the activity of the

precious metals, or promote the water gas shift reaction. See for example, B. Harrison, A. F. Diwell and C. Hallet, Platinum Metals Rev., 1988, 32(2), 73-78.

Col. 1, lines 43-56. This is not a teaching or suggestion that Nunan's catalyst (or any other motor vehicle exhaust conversion catalysts) could be used in a water gas shift converters.

The water gas shift reaction and water gas shift converters are not even mentioned in the Summary of the Invention at col. 2, lines 46-62.

> It is an object of the present invention to provide an *exhaust conversion catalyst support material* that is highly effective in enhancing the performance of catalytically active metals deposited thereon in *the conversion of noxious components in the exhaust from internal combustion engines* to compounds that are not detrimental to the environment. The promoted support materials of the present invention comprise substantially homogeneous, compositions of mixed-metal oxide crystallites supported and dispersed on a high surface area support and characterized in that the average size of the crystallite is about 100 Å or less, preferably about 50 Å or less, and wherein the mixed-metal oxide contains cerium or zirconium as the predominant metal in combination with at least one additional secondary metal, the ratio and distribution of the metal atoms within said mixed-metal oxides being substantially uniform throughout the crystallite.

This citation does not teach or suggest the use of Nunan's motor vehicle exhaust conversion catalyst in water gas shift converters.

The only mention of the water gas shift reaction in Nunan is the statement discussed above that cerium might promote this reaction. This is not a teaching or suggestion that Nunan's motor vehicle exhaust conversion catalyst could be used in a water gas shift converter.

With respect to claims 10-11, 22-23, and 34-35, the examiner stated that "Nunan teaches wherein the process fuel gas passes through the water gas shift at a temperature of about 225°C (col. 15, lines 53-57)." First, col. 15, lines 53-57 relates to catalyst systems made using commercial mixed metal oxide materials, not to Nunan's catalysts.

> Additionally, the *catalyst systems made with the commercial Santoku materials* have been shown to have an enhanced low temperature CeO_2 reduction feature at about 225°C. as shown in FIG. 3. These enhancements are thought to be the result of Zr doping of the CeO_2 lattice.

Col. 15, lines 53-57. The commercial mixed oxides are described at col. 15, lines 21-27.

Commercial Ce,Zr mixed oxide materials are available from companies such as Santoku Mining Company. These materials, when incorporated into Pt,Rh catalysts, showed performance advantages after severe dynamometer aging. However, the performance advantages were only observed for materials that contained $\geq$ 10 wt. % Zr as shown in FIGS. 1 and 2.

In addition, the water gas shift reaction is not even mentioned. The references in Figs. 1 and 2 to the A/F ratio clearly indicate that the statements relate to motor vehicle exhaust conversion catalysts, not water gas shift converters.

Therefore, claims 1-61 are not anticipated by, nor would they have been obvious to one of ordinary skill in the art at the time the invention was made over, Nunan.

CONCLUSION

Applicant respectfully submits that, in view of the above amendment and remarks, the application is now in condition for allowance. Applicant respectfully requests that claims 1-61 be passed to allowance.

If the Examiner has any questions or comments regarding the present application, he is invited to contact the undersigned attorney at the telephone number indicated below.

Respectfully submitted,
DINSMORE & SHOHL LLP

By /Patricia L. Prior/
Patricia L. Prior
Registration No. 33,758

One Dayton Centre
One South Main Street, Suite 1300
Dayton, Ohio 45402-2023
Telephone: (937) 449-6400
Facsimile: (937) 449-6405

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Enclosures